SAFETY DIGEST

U.S. ARMY MATERIEL COMMAND

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The Safety Digest is an AMC Pamphlet prepared by the Safety Office, Headquarters, US Army Materiel Command. Its purpose is to disseminate information which can materially influence and improve safety programs at all command establishments.

Articles are included to supplement technical knowledge as well as practical knowledge gained through experience. They provide a basis for the further refinement of safety measures already incorporated in operating procedures and process layout. To achieve maximum effectiveness, the Safety Digest should be given widespread circulation at each AMC establishment.

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(AMCSF)

FOR THE COMMANDER:

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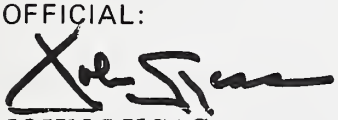
Major General, USA
Chief of Staff

OFFICIAL:



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IN THIS ISSUE

QUANTIFIED HAZARDS ANALYSIS OF WEAPON SYSTEMS DESIGN

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Introduction

This article describes a relatively new and straightforward technique developed for identifying and quantitatively analyzing potential hazards inherent in weapon systems design. Through integrated efforts by personnel from the reliability and safety disciplines, a more realistic numerical risk assessment can be employed to pin-point hazardous conditions which must be reduced. Various remedial techniques which can be applied to reduce risks to acceptable levels are also discussed.

Numerous articles have reported incidents testifying to the urgent need for early elimination of potentially hazardous conditions associated with weapon systems. Avoidance of loss of life, or personal injury, is of course of paramount consideration. Furthermore, the high cost of injuries as well as equipment damage and subsequent redesign and retrofit actions, can in many cases be substantially reduced. This can be accomplished by a relatively inexpensive safety program conducted during initial design, development and testing of new weapon systems. Awareness of the importance of early safety evaluation has been amply demonstrated by the significant increase in contract data requirements for varying applications of safety program efforts in recent Government procurement contracts.

The significant point to emphasize is that typical safety analyses provide only a qualitative measure of hazards stated in relative terms or classifications (i.e., Categories I through IV, per MIL-STD-882). This, unfortunately, does not consider the probability of the hazardous condition occurring. On the other hand, a combination of hazard level and probability of occurrence permits a quantitative analysis resulting in a more realistic numerical risk assessment and ranking of potential hazards, with the subsequent evaluation of methods for their reduction.

The Hazards Logic Tree

The initial effort in an analysis requires identification of potential safety problems (regardless of remoteness), the hazardous categories which may be contributory, and the basic failure modes or causes.

The recommended approach is a "top down" analysis as contrasted to the widely used "bottom up" conventional failure modes and effects analysis (FMEA). The former can be quite quickly and economically developed whereas the FMEA is a relatively exhaustive and comprehensive analysis considering every possible mode of failure, many of which would not contribute to a hazardous condition. However, if the reliability engineer is concurrently developing an FMEA, it is wise to cross-check it for any potential safety problems which may be newly revealed.

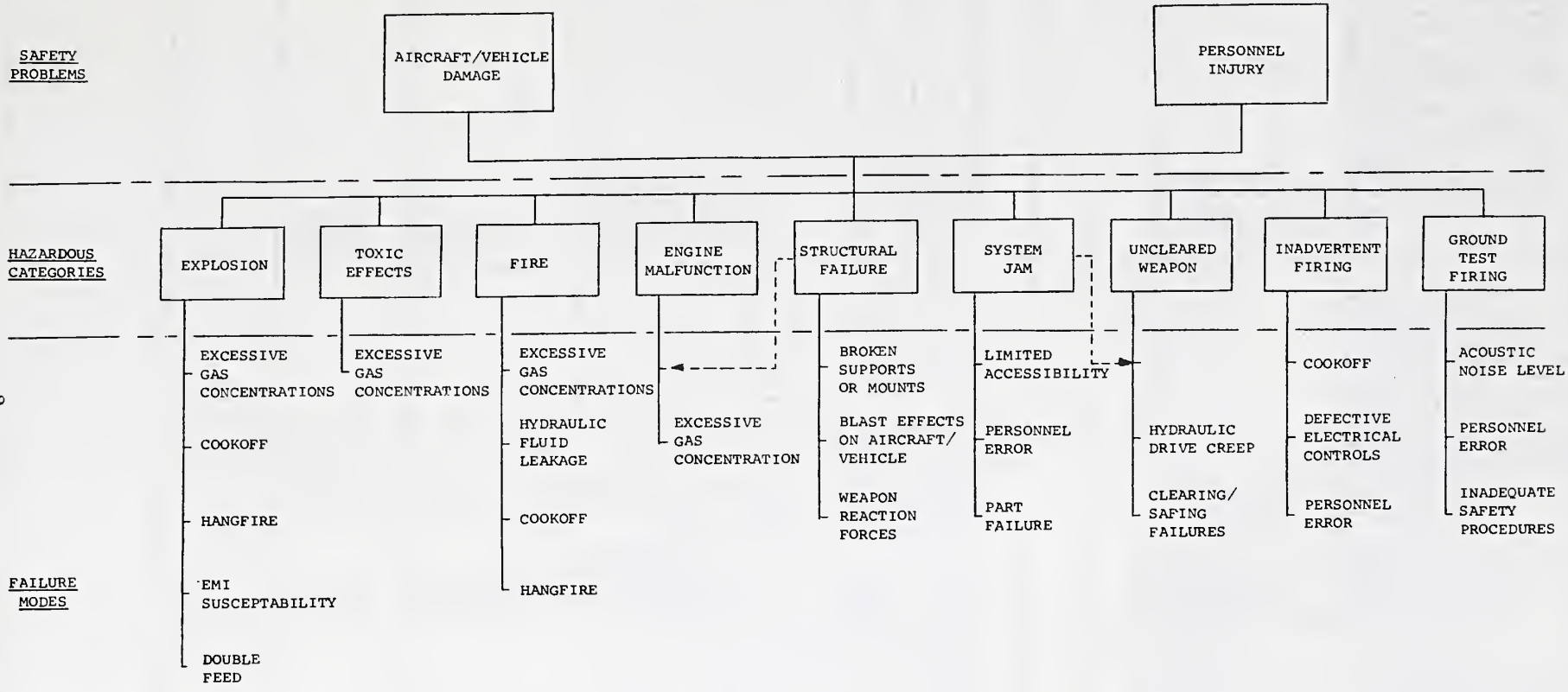
A thorough technical and functional knowledge of the weapon system being evaluated is essential for meaningful hazards analysis. This can be achieved through frequent consultations, analyses and reviews with responsible design engineering personnel. The earlier in the development program that this can be achieved, the greater the likelihood that changes can be incorporated to reduce potentially hazardous features with a minimum of cost, schedule slippage or design problems.

The product of this initial safety analysis, which is subject to continuing development and refinement, is the Hazards Logic Tree. A typical example, recently generated for an aircraft weapons system, is illustrated in Figure 1. It is interesting to note that certain of the specific hazardous categories may in turn constitute failure modes contributing to other hazardous conditions.

Hazardous Failure Modes Analysis (HFMA)

Based on the elements of the logic tree, a detailed Hazardous Failure Modes Analysis is readily developed for each of the hazard categories. As a minimum it is recommended that the following items be included in the analysis:

1. Component(s) involved
2. Failure mode
3. System operation mode
4. Cause(s)
5. Probability of damage/injury
6. Hazard classification
7. Corrective action(s)
8. Remarks and recommendations



HAZARDS LOGIC TREE

FIGURE 1

HAZARD CATEGORY	COMPONENT	FAILURE MODE	SYSTEM OPERATION MODE	CAUSE		PROBABILITY DAMAGE/INJURY	HAZARD CLASSIFICATION			CORRECTIVE ACTION	REMARKS & RECOMMENDATIONS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
I. Explosion	A. Gun Installation	Gun Gas Detonation	Long Burst Firing	Excessive Gun Gas concentration		Moder-ate					(1) Provide adequate purging to keep gun gas concentration to acceptable level. (2) Effectively seal gun compartment from other sections of aircraft and from gun muzzle.	Adequate aircraft purging and venting design should be confirmed by test to assure low gun gas concentration levels. Prior aircraft gun installations have demonstrated that this is a remote safety problem if evaluated in initial installation design.
	B. Ammunition	(1) Cookoff (May occur in gun or AHS)	Long Burst Firing or Highly Repetitive Short Burst Firing	Ammo exposure to high temperature (350°F propellant temperature @ 1 minute exposure).		Low/ Moder-ate	II				(1) Clearing mechanism holds rounds in rear of gun after firing (2) Purging and venting provided for gun	Further evaluation recommended in view of potential effects of hot ram air flow through gun barrels in high performance aircraft.
		(2) Hangfire (in Return Chute)	Gun Firing	Delay in primer mechanism action		Moder-ate/ High Low	(III) (II)				None - AHS will be rendered inoperative (jammed and damaged)	Consider installation of plastic ballistic sheet over return chuting which has been successfully demonstrated on other installations. Note: Hangfire of an unconfined round will probably result in low level detonation, debulleting, minimal of shrapnel effects from brass case, and no anticipated reaction to adjacent ammo. Possibility of fire if combustible materials (oil, grease) in area.
		(3) EMI Susceptability of Electric Primers	Ground/Shipboard Environment (Loading, Handling, etc.)	High electro-magnetic field may ignite primer, particularly if primer is touched with object which acts as antenna.		Low/ Moder-ate	(II) or (III) TBD based on further testing				(1) Rounds belted in Mk 7 Mod 0 Radhaz links prior to loading in system. (2) Grounding straps provided on AHS	(1) Rounds(s) be recoupled in Radhaz links on removal from AHS (2) Government agencies are conducting further tests on susceptability of electric primers to EMI. (3) Firing lead in Control Box should be grounded until trigger switch is actuated. (4) Ammo in gun system is considered adequately EMI shielded. (5) Ultimate use of Bulk Loader would provide long range solution to Radhaz problem.
	C. Gun, AHS or Ammunition	Double Feed (Feeding Round into Barrel Containing Unfired Round or Whole or Partial Case)	Gun Firing	(1) Defective Ammo (2) Defective gun bolt (3) Improper ammo feed. (4) Personnel error.		Moder-ate	II				(1) Round repositioner in transfer unit to correct improperly linked rounds.	

FIGURE 2

A convenient format for graphic display of this analysis is illustrated in Figure 2. The example cited -- explosion -- is a serious potential hazardous condition because of the difficulty in providing prior warning and possible primary and secondary effects on personnel, aircraft and/or its equipment, and surface-based facilities.

Hazard Classification

In the past, a qualitative evaluation has been made of each hazardous condition in accordance with MIL-STD-882. This classified the hazard in one of four categories as defined in this Standard, mainly: Level I - Negligible; Level II - Marginal; Level III - Critical; Level IV - Catastrophic.

Quantitative Analysis

The efforts up to this point in the development of the hazards analysis have been primarily in the domain of safety engineering, and are essentially qualitative in nature. At this phase, the reliability engineer analyzes the failure modes and causes itemized in the HFMA (Reference Figure 2), and establishes failure probability data for each. In the system example cited, no attempt was made to apply specific reliability numbers but rather to indicate one of four ranges of probability of failure occurrence. The reason for this is that human error can play a significant role in a system that requires relatively high personnel involvement; that is, operator errors, ammunition loading and down loading, servicing, maintenance, etc. However, for the purpose and intent of this quantitative analysis, four failure probability ranges are adequate. Weighting factors are also assigned with values increasing as probability increases, as illustrated in Table 1. These values are included in the HFMA chart as indicated.

Range	Failure Probability (HFMA Column 6)	Weighting Factor (HFMA Column 9)
$0.00001 \geq Po \geq 0$	Very Low	1
$0.0001 \geq Po \geq 0.00001$	Low	2
$0.001 \geq Po \geq 0.0001$	Moderate	3
$1 \geq Po \geq 0.001$	High	4

Table 1
Probability of Failure Occurrence (Po)

Similarly, weighting factors are assigned to the hazard levels. Categories I through IV will have corresponding factors assigned as 1 through 4 and entered in Column 10 of the HFMA.

Therefore, the relative risk level of the various hazardous conditions can be ranked by multiplying the weighting factors for hazard level with those of probability of failure. These in turn are entered on the HFMA Chart in Column 11.

Quantitative Safety Rating Factor (HFMA Column 11)	Risk Level
1 thru 4	Remote
5 thru 8	Marginal
9 thru 12	Critical
13 thru 16	Catastrophic

Table 2
Quantitative Safety Rating Factor

The completed HFMA now reflects a safety rating based on a combination of hazard level and failure probability which gives a more realistic appraisal of hazardous conditions. This more clearly emphasizes the conditions requiring priority for evaluation of techniques for reducing the hazard to an acceptable level. For example, Figure 3 depicting the completed HFMA, indicates that an explosion condition due to ammunition electro-magnetic interference (EMI) susceptibility is remote (rated 2 to 3) whereas an ammunition hangfire borders on a marginal risk assessment (rated 4 to 6) and warrants priority action to reduce the potential risk.

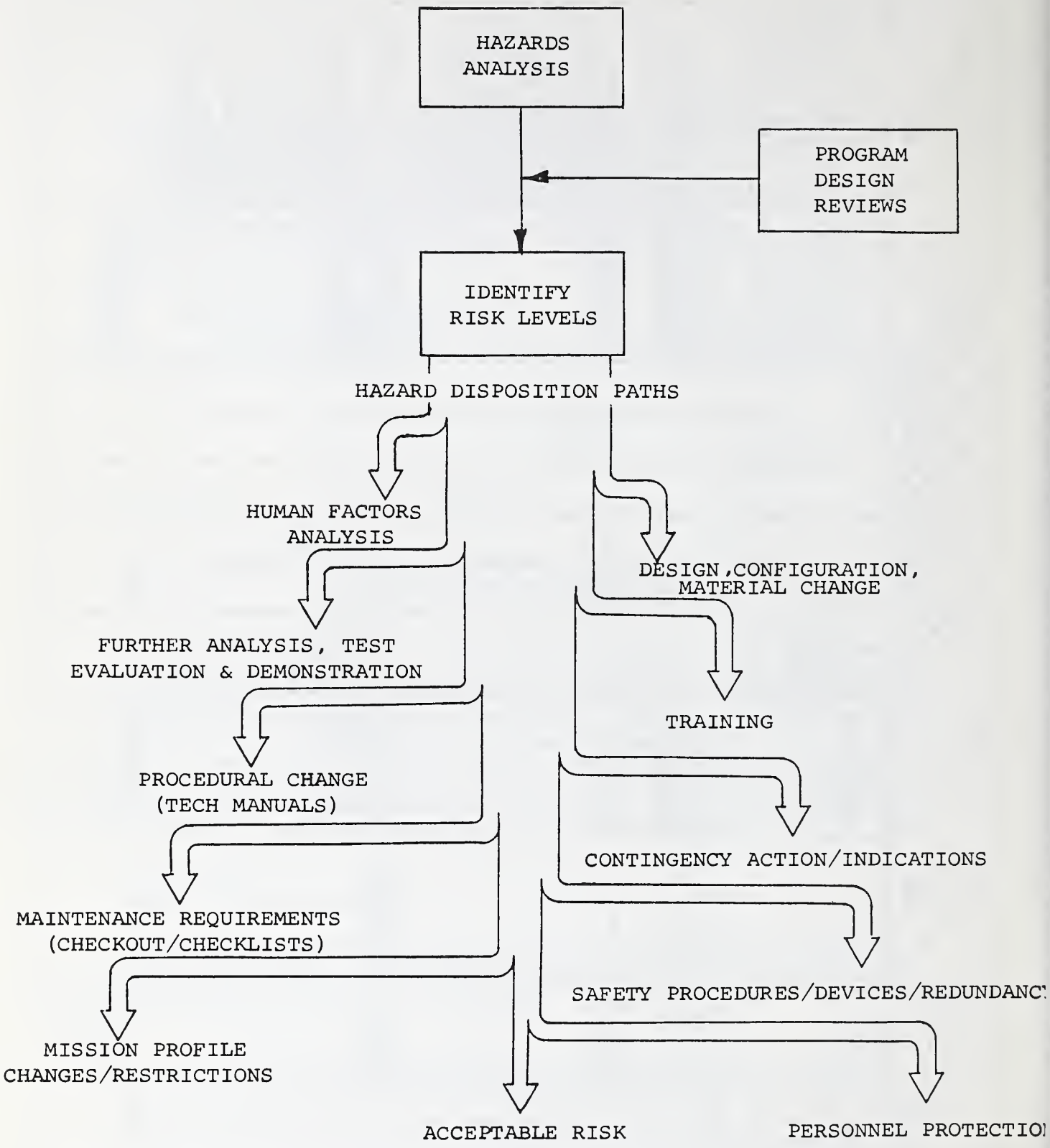
Hazard Reduction Techniques

The groundwork has now been established for a concerted effort to reduce hazards which the quantitative analysis indicate have a high and unacceptable risk level. Many techniques may be employed in improving system safety as illustrated by the flow chart in Figure 4.

The methods, as illustrated above, are self-explanatory, and the point to be made is that there are many techniques other than major redesign which can alleviate or eliminate potentially hazardous conditions. It must be emphasized, as mentioned initially, that the earlier the safety effort on each program can be initiated, the greater the probability of reducing risk levels with a minimum impact on the overall program.

HAZARD CATEGORY	COMPONENT	FAILURE MODE	SYSTEM OPERATION MODE	CAUSE	FAILURE PROBABILITY	PROBABILITY DAMAGE/INJURY	HAZARD CLASSIFICATION	PROBABILITY WEIGHTING FACTOR	HAZARD WEIGHTING FACTOR	QUANTITATIVE SAFETY RATING FACTOR	CORRECTIVE ACTION	REMARKS & RECOMMENDATIONS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Explosion	A. Gun installation	Gun Gas Detonation	Long Burst Firing	Excessive Gun Gas concentration	Very low (if evaluated and corrected in initial installation design).	Moderate	II	1	2	2	(1) Provide adequate purging to keep gun gas concentration to acceptable level. (2) Effectively seal gun compartment from other sections of aircraft and from gun muzzle.	Adequate aircraft purging and venting design should be confirmed by test to assure low gun gas concentration levels. Prior aircraft gun installations have demonstrated that this is a remote safety problem if evaluated in initial installation design.
	B. Ammunition	(1) Cookoff (May occur in gun or AHS)	Long Burst Firing or Highly Repetitive Short Burst Firing	Ammo exposure to high temperature (350°F propellant temperature @ 1 minute exposure).	Low	Low/ Moderate	II	2	2	4	(1) Clearing mechanism holds rounds in rear of gun after firing (2) Purging and venting provided for gun	Further evaluation recommended in view of potential effects of hot ram air flow through gun barrels in high performance aircraft.
		(2) Hangfire (in Return Chute)	Gun Firing	Delay in primer mechanism action	Low	Moderate/ High Low	(III) (II)	2	3 2(with ballistic shield)	6 4	None - AHS will be rendered inoperative (jammed and damaged)	Consider installation of plastic ballistic sheet over return chuting which has been successfully demonstrated on other installations Note: Hangfire of an unconfined round will probably result in low level detonation, debulleting, minimal of shrapnel effects from brass case, and no anticipated reaction to adjacent ammo. Possibility of fire if combustible materials (oil, grease in area.
		(3) EMI Susceptability of Electric Primers	Ground/Shipboard Environment (Loading, Handling, etc.)	High electro-magnetic field may ignite primer, particularly if primer is touched with object which acts as antenna.	Very low (Based on many years of tactical usage with no incidents reported)	Low/ Moderate	(II) or (III) TBD based on further testing	1	2/3	2/3 (tentative)	(1) Rounds belted in Mk 7 Mod 0 Radhaz links prior to loading in system. (2) Grounding straps provided on AHS	(1) Round(s) be recoupled in Radhaz links on removal from AHS (2) Government agencies are conducting further tests on susceptability of electric primers to EMI. (3) Firing lead in Control Box should be grounded until trigger switch is actuated. (4) Ammo in gun system is considered adequately EMI shielded. (5) Ultimate use of Bulk Loader would provide long range solution to Radhaz problem.
	C. Gun, AHS or Ammunition	Double Feed (Feeding Round into Barrel Containing Unfired Round or Whole or Partial Case)	Gun Firing	(1) Defective Ammo (2) Defective gun bolt (3) Improper ammo feed. (4) Personnel error.	Low	Moderate	II	2	2	4	(1) Round repositioner in transfer unit to correct improperly linked rounds.	

FIGURE 3



HAZARD REDUCTION FLOW CHART

FIGURE 4

Conclusions

The Quantified Hazards Analysis is not a "one-shot" effort but an iterative process which is continued until all identified hazardous conditions are reduced to acceptable levels. It cannot be successfully achieved by a one-man effort but requires the joint, cooperative endeavor of all disciplines involved in the system design, including the airframe/vehicle contractor and the using agency. In addition to the safety improvements that can be achieved, other program goals will also benefit; i.e., cost, schedule and performance.

Although the example cited relates to successful application of the technique in the development of a specific weapon system, it may readily be applied to other military programs where safety considerations are necessary, and perhaps paramount.

References

1. Requirements for System Safety Program for Systems and Associated Subsystems and Equipment, MIL-STD-882.

2. Ground Handling of Aircraft Containing Ammunition and Explosive Material, Tech Manual TO 11A-1-33.

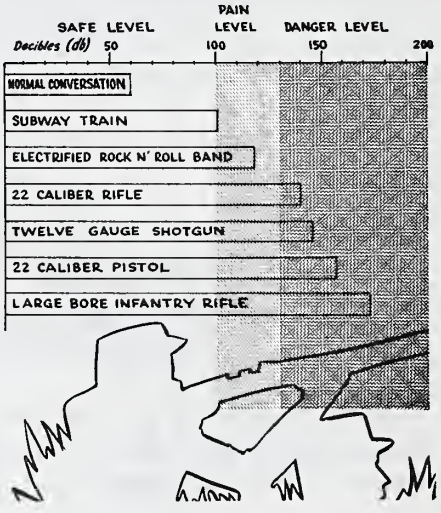
3. Hazards Analysis in the Apollo Applications Program; H. Cohen, NASA, Washington, DC; and J. M. Cooper, General Electric Company, Daytona Beach, Florida, AIAA Paper No. 68-1057.

Editor's Note: This paper presents yet another method of evaluating safety features in a quantitative manner, based on an arbitrary set of numbers relating to hazard classifications per MIL-STD-882. The final product, a quantitative safety rating factor, is obtained by multiplying a probability weighting factor by a hazard weighting factor. The weighting factor for the failure probability is assigned for a range of values designed to account for personnel error effect. Reliability numbers, derived from the failure probability of each item analyzed, are also contained in this range of values. In many cases, this technique may be of value and study by readers is merited.

HUNTING SAFETY

(Editor's Note: A Central Safety Board presentation, submitted by P. H. Therrell, Sr., Safety Inspector, Sperry Rand Corporation, Louisiana Army Ammunition Plant.)

Are you shooting your hearing? This was the question asked by Mr. Robert A. Lee, Safety Inspection Department Manager, Sperry Rand Corporation, at a recent Central Safety Board meeting at Louisiana Army Ammunition Plant. Mr. Lee's topic of discussion was the potential hearing loss resulting from the use of firearms.

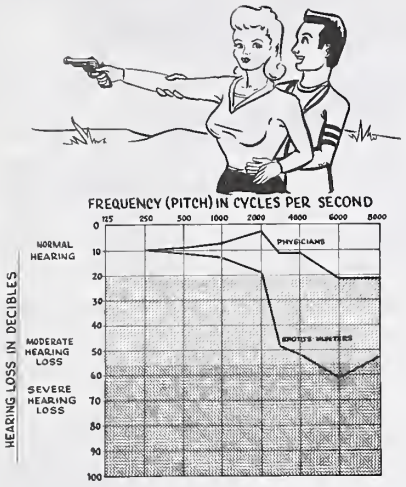


While hunting and after shooting, sometimes an individual's ears ring and there is no question that he has some degree of temporary hearing loss. However, the high intensity sound of shooting often causes a high frequency loss that is permanent and cannot be treated.

Partial deafness after exposure to noise is well known to boilermakers, jetport ground crews, and any parent who has visited a teenagers' electrified rock dance. Most firearms users can cite similar episodes of hearing loss from shooting noise, and yet it is a widely held opinion among sportsmen that these losses are insignificant or at worst, only temporary. The facts, however, tell a different story. The temporary deafness initially suffered by persons exposed to excessively loud noises does become permanent after repeated or prolonged exposure.

The decibel (dB) is a mathematical term for denoting sound energy. In simple terms, every 3 dB increase in the sound-pressure level indicates a doubling of sound intensity. A 12-gauge shotgun has been measured at 140 dB.

It is now an accepted fact that sound-pressure levels of over 130 dB cause irreversible hearing damage. Handguns and other short-barreled firearms, even those of small caliber produce an unexpectedly loud (sharp) report. For example, while the peak sound-pressure level from a .22 caliber rifle measures out at 139 dB, a .22 caliber pistol delivers an ear-splitting 153 dB. The 14 dB difference, in mathematical terms, means



almost five times as much sound-energy production. Both of these levels are damaging, but the pistol is much more so.

The hunter in the field who may be listening for the sound of a bird in flight, the bay of his dogs or the rustling of a rattlesnake is understandably reluctant to wear hearing protection devices. He is not immune to hearing damage but will suffer less damage if he shoots in the open, shoots only a few rounds and avoids standing close to another shooter. Mr. Lee concluded his presentation by displaying several samples of proper hearing protective devices such as earmuffs or earplugs, and recommended that they be used by persons using firearms if at all practical.

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NEW WISE OWL CLUB MEMBER

Clifford J. Moore, a maintenance employee at Lake City Army Ammunition Plant, saved his sight with safety glasses when an anvil shaft broke and flew up into his face.

The incident occurred when Mr. Moore (left) had silver soldered an anvil shaft for a cast taper machine. He placed the anvil in the collet on a Harding lathe and polished the soldered joint. After this was completed, he removed the anvil and shaft from the collet and placed the shaft end in the collet, to check the assembly for alignment. In the process the stem broke and the anvil struck his forehead and safety glasses.

Mr. Moore had a bump on his forehead and a handful of glass particles where the lens used to be, but his eyes were intact. This incident has gained membership for Mr. Moore in the Wise Owl Club sponsored by the National Association for the Prevention of Blindness.

SAFETY OPERATING RULES FOR PLANTS MANUFACTURING, LOADING, HANDLING, OR STORING POWDER, EXPLOSIVES, AND LOADED SHELL.

Pursuant to Ordnance Department Office Order No. 321 of the Chief of Ordnance, the following rules are hereby promulgated by the Board of Officers designated for this work. These rules, as formulated herein, offer the minimum requirements considered compatible with proper safeguarding of our workers. It is not the intention of these rules to limit manufacturers in this direction, and it should be expressly understood by all that manufacturers are entirely free to superimpose upon these rules, as a foundation, any additional safety rules that in their respective cases are proper because of certain local conditions which necessarily could not be covered by general rules of this character.

GENERAL.

Scope.—The following rules and regulations govern rooms, buildings, or portions of the plant in which the following materials are manufactured, loaded, handled, or stored:

(a) Substances in such form and condition as to be liable to ignition or explosion from spark, heat, friction, or accidental shock. These include, among other hazardous materials, T. N. T., amatol, explosive "D," picric acid, tetryl, T. N. A., double-base smokeless powders, dry guncotton, dry nitrostarch, and dry fulminate of mercury, but not wet or dehydrated guncotton, or wet nitrostarch, ammonium nitrate, or wet fulminate of mercury.

(b) Substances in such form and condition as to be liable to violent combustion with the generation of high pressures if confined. These include single-base smokeless powder in the dry state, tracer bullet compositions, and similar compounds or mixtures. Explosive vapors are not included, excepting so far as the following rules are practicably applicable to the processes concerned, and if so applied will operate to reduce the danger of explosion or violent combustion.

Definitions.—The following definitions will apply throughout the following rules:

Hazardous Materials.—These substances included under the preceding paragraphs.

Operating Buildings.—Buildings, rooms, or portions of the plant in which operatives are regularly employed in the process of manufacturing, loading, packing, or otherwise handling hazardous materials.

Magazines.—Buildings, rooms, or portions of the plant in which hazardous materials are kept or stored, and in which operatives are not regularly and continuously employed.

RULES AND REGULATIONS.

1. These rules must be brought to the attention of all employees at the time of their employment and explained to them. They shall be posted in all operating buildings and magazines. Employees are to be continually impressed with the necessity of obeying them at all times.

2. All operatives, inspectors, mechanics, and others who come in contact with hazardous materials must have the danger of fire and explosion clearly explained to them, and also the possible causes of fire and explosion. They must be instructed on the best means of escape from their building and its vicinity.

3. Inexperienced operatives and others must not be allowed to perform new duties in connection with hazardous materials until they have been carefully instructed, and their work must be continuously supervised by a more experienced operator or by the foreman until they can be safely trusted to work alone.

4. Persons who are or who have been mentally unsound, feeble-minded, maliciously or criminally inclined, subject to fits, epilepsy, or lapses of consciousness, addicted to or under the influence of drugs, narcotics, or intoxicating liquors, or who are habitually careless or indifferent to the hazards of their occupation, or who willfully disregard these rules after such disobedience is brought to their attention, must not be employed within this portion of the plant, nor shall persons under an assumed name.

5. Employees are to be allowed on the plant only at such times and in or around such buildings as their duties require.

6. Lunches and other meals are not to be eaten in or around operating buildings or magazines, except in cases where the continuance of the operation so requires.

7. Employees must not keep personal effects in operating buildings or magazines, or extra clothing other than that which is necessary for immediate wear outdoors.

8. To prevent the entrance of unauthorized persons, the plant or that portion of the plant containing operating buildings or magazines must be completely inclosed by suitable fencing, which shall be lighted and patrolled by guards. All entrances must be suitably guarded.

9. No person shall be allowed to enter the above portion of the plant without exhibiting a suitable pass and being identified as its rightful owner.

10. No person shall be allowed to enter with or carry with him in this portion of the plant matches or any other fire or flame-producing device, including caps and detonators, unless authorized by management or plant rules. Permits must be issued for carrying only safety matches within a covered metal receptacle, or oil lanterns for use where no safer form of light is possible. Such matches or lanterns must not be taken close to hazardous materials or into buildings or cars containing hazardous materials.

11. Smoking in that portion of the plant is prohibited, except in properly designated detached buildings or inclosures at least 200 feet from operating buildings or magazines.

12. Ample provision for lighting cigarettes and pipes must be maintained outside each plant gate.

13. Within or upon all operating buildings and magazines a conspicuous sign is to be posted, stating the maximum number of regular operatives and foremen and the maximum number of additional persons, such as extra foremen, repairmen, truckmen, inspectors, visitors, and others, including employees under instruction and Government representatives, which shall be allowed in the building or its immediate vicinity during operations. These limits are to be the minimum consistent with continued and satisfactory operation of the plant or process. The operating foreman of the building is to be strictly responsible for the enforcement of these limits. It shall be his duty to at once warn anyone who by entering exceeds these limits, and if the number is not at once reduced, he shall stop operations and withdraw his crew.

14. The foreman or other person in charge of an operating building or magazine must satisfy himself as to the identity of any persons entering or approaching his building and their right to enter. He is to be given the authority, and is to exercise the right, to order them to leave or to eject them, if their presence or actions are prejudicial to safety.

15. A daily record must be kept in the main office of the names of operatives at work on each shift in each operating building and magazine and others regularly employed in the vicinity. A permanent record shall be kept at the plant, showing the place of residence of such employees and the names and addresses of their nearest relatives.

16. The foreman of each shift or crew, or some appointed person, must examine all equipment before work is commenced, to ascertain that it is in proper and safe working condition, that the building is clean and free from objectionable material or unnecessary tools, and that safety exits are not obstructed.

17. If machinery or other equipment is out of order, or gives indication of improper operation or serious defect, or if dangerous foreign substances or objects are discovered in hazardous materials, work must be stopped at once unless the danger is at once removed. All such cases must be reported to the plant authorities.

18. No repairs, construction, experiments, or tests, or other than routine work are to be undertaken in any operating building or magazine during operations without first advising the foreman or others in charge. If such work adds to the general hazard and can be otherwise performed, it must not be done during operations nor with unnecessary persons present.

19. Major repairs or changes are not to be undertaken in an operating building or magazine during regular operations; nor without the removal of the hazardous materials; nor without the knowledge and consent of the employee in immediate charge of the building; nor by an unauthorized person; nor with unnecessary persons present or in the immediate vicinity. Loose hazardous materials are to be cleaned up and surfaces washed or decontaminated as far as practicable.

20. Immediately after such repairs or changes, all tools and material must be removed and accounted for before the building is in proper condition to operate. The person in immediate charge of such work may remain in the building to see that it operates properly, but he shall then send his assistants to a safe distance.

21. Waste materials, condemned equipment, sweepings, or refuse containing or contaminated with hazardous materials must not be left in or near operating buildings or magazines. It should be taken as soon as practicable in covered containers to a fenced and locked inclosure or to buildings set apart for its recovery, or to the burning ground, to be burned in small quantities under careful supervision. Such material must not be buried nor thrown into any stream or tidewater unless it is decomposed by or is soluble in water. It should not be emptied into closed drains. Used equipment so contaminated must not be taken or shipped outside the plant or carried into the safety area until it has been freed from contamination.

22. Before freight cars, wagons, and other conveyances or carriers which have contained hazardous materials leave the plant, they must be inspected and freed from contamination.

23. Signs stating the maximum amount of hazardous material allowed inside must be posted to each operating building and magazine. These limits in the case of operating buildings shall be the lowest consistent with continued and satisfactory operation of the plant or process, and in all cases due regard must be had to the safety of adjacent buildings from the effects of fire or explosion. Responsible employees must be charged with the duty of maintaining these limits.

24. Hazardous materials that have been spilled in buildings or along tracks or roads must be taken up at once, and no such material shall be allowed to accumulate under flooring or in other concealed spaces. All operating buildings and magazines must be kept clean and orderly, and their immediate surroundings must be maintained clear of rubbish, undergrowth, and other readily inflammable matter. All implements must be kept in their proper places. Explosive or highly inflammable dust must not be permitted to accumulate.

25. No operations in which hazardous materials are involved, other than their addition or removal, shall be permitted in magazines. Packages, boxes, or other containers of these materials must not be opened in such buildings.

26. Metal tools or other implements used in the vicinity of hazardous materials liable to ignition, explosion, or detonation from spark or friction must be handled carefully and kept clean. Metal tools used in any operation shall be only those approved by the management, and the method of their use must be specifically outlined.

27. The containers of hazardous materials, shell and other heavy objects must be lifted or wheeled, and not dragged, dropped, or thrown about in operating buildings and magazines.

28. Tramcars, trucks, and other conveyances used for the transportation of hazardous materials must be so arranged that no part of the load is liable to fall off. Such transportation must be done carefully.

29. Employees in operating buildings or magazines containing hazardous materials liable to ignition, explosion, or detonation from spark or friction must not wear shoes with exposed metal nails or plates, unless covered by wound overshoes. (This does not apply to storage depots where no manufacturing function is performed.) Shoes must be carefully cleansed of mud and grit before such buildings are entered. The clothing of these employees should not contain ... until attachments, and loose metal objects should not be carried in the pockets. Pockets in the clothing should, as far as practicable, be eliminated. In the case of shell-loading plants, the foregoing provision, as regards special shoes or rubber overshoes, is of major importance as applied to those portions of the operating areas where hazardous materials are involved in the processes, as the presence of grit, etc., should be here prevented as far as practicable. Special supplementary rules may be promulgated to cover such cases.

30. Clothing and underclothing which are impregnated with hazardous materials must not be worn outside the plant, nor shall employees so clad approach a fire, lead heaters or furnaces, operate unprotected electric switches, carry matches or lighted lanterns, or smoke. As far as practicable, such impregnation must be avoided by frequent changes of clothing.

31. No persons shall be allowed to enter operating buildings or magazines with firearms or ammunition therefor, except officers and enlisted men of the Army and Navy of the United States, and then only in an emergency.

32. All steam locomotives operating within that portion of the plant containing operating buildings and magazines must be equipped with effective spark arresters and properly protected fire boxes. Fires must not be lighted or dumped within this area. Hazardous materials must not be carried on locomotives or tenders, but in box cars. They may be carried on flat cars if inclosed in tight wooden or metal containers.

33. Portable fire extinguishers must be carried on all electric or steam locomotives and motor trucks.

34. No hazardous materials shall be carried on electric locomotives.

35. Steam and electric locomotives must not be allowed to stand close to operating buildings or magazines (except loaded shell storages) while cars are being loaded or unloaded.

Cars not being loaded or unloaded must not be allowed to stand nearer than two hundred (200) feet to operating buildings and magazines.

36. Hazardous materials in loose or liquid form should be transported in covered containers. No liquid explosives shall be carried outside a building by hand in buckets, unless special permission is obtained from the manager.

37. The following heating systems only must be used in operating buildings or magazines:

(a) Direct heating by hot water or steam, at not over 5 pounds pressure.

(b) Indirect heating by steam coils and blower, with this equipment located in a separate building or room.

Low-pressure steam-heating systems must be equipped with automatic pressure-regulating valve and weighted relief valve set for the maximum pressure. Hot-water systems must be equipped with expansion tank. Heating furnaces must be placed in a separate building at least 30 feet away, and furnace stacks must be provided with efficient spark arresters. The air intake of blower systems must be carefully screened.

38. The dust or hazardous materials, clothing, paper, and other inflammables must be kept off radiators and heating coils. Radiators, heating coils, and piping must not be in contact with woodwork, and must be readily accessible for inspection.

39. As far as practicable, power transmission machinery should be external to operating buildings. All bearings must be frequently examined and oiled.

40. Electric motors must not be located in rooms containing loose hazardous material liable to ignition from sparks.

41. All electric wiring within operating buildings or magazines must be in conduit or cable installed in accordance with the underwriters' standards. There must be no key sockets, switches, fuses, or starters inside. All lights must have an outer globe or a solid protecting fixture of some type.

42. Employees are forbidden to make changes or to tamper with electric equipment unless properly authorized. While there are hazardous materials in the building, outer globes or protecting fixtures must not be removed unless all current is cut off from the outside, and they must be replaced before current is turned on.

43. Portable extension lights must not be introduced into operating buildings or magazines while hazardous materials are present. At other times when used such lights must be equipped with outer globe and cage, keyless socket, and reenforced or armored extension cord.

44. All heating systems, pipe lines, high-speed belts and other apparatus liable to differences of electrical potential must be properly grounded.

45. Only waste must be kept in approved waste cans.

46. Paints, oils, etc., unnecessary to the operation, shall not be permitted to remain in operating building.

47. Satisfactory drowning tanks and arrangements for rapid drowning must be provided for all hazardous materials in an acid state which are liable to decomposition.

48. Nitrators for hazardous materials which are liable to decomposition during nitration must be provided with at least two means of agitation.

49. Sufficient exits must be provided in operating buildings and dry houses to permit all operatives to make quick escape without danger of congestion at the exits themselves. Exit doors must open outward, and during working hours must be secured only by safety latches which will yield readily to pressure from the inside. Such exits must lead directly to routes which will permit operatives to escape from the vicinity of the building itself. These routes must be free from tripping hazards, obstructions, and pitfalls, and should have no drops over 24 inches in height; if necessary, ramps or runways being provided.

All safety exits must be kept clear of obstructions. Thresholds must not be over 6 inches in height, and there should be sufficient head room. Safety exits must be painted a distinguishing color and plainly marked with a conspicuous sign reading "SAFETY EXIT."

50. Safety exits must be provided for all operating floors above the first and furnished with external escapes leading away from the building. These should be chutes or inclines, rather than stairs.

51. Hand fire equipment may be provided inside operating buildings and magazines, but operatives must be warned against its use if an explosion is imminent. In the case of fires in buildings containing large quantities of T. N. T., loaded shells, and other explosives which may detonate or explode after exposure to intense heat, employees must be warned to leave the vicinity after the fire has passed the incipient stage. This applies also to hazardous materials in closed vessels or tanks exposed to intense heat.

NOVEMBER, 1918.

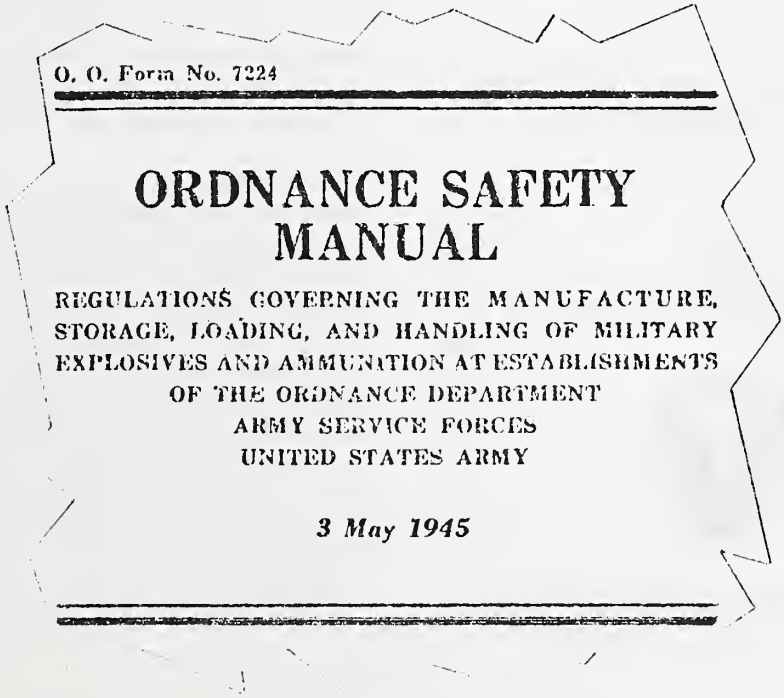
C. C. WILLIAMS,
Maj. Gen. Chief of Ordnance,
U. S. A.

THE AMC SAFETY MANUAL....PAST AND PRESENT

We don't know who said it, but it certainly is true -- "Mighty oaks from little acorns grow!" One of these "mighty oaks" with which we all are, or should be, intimately familiar is AMCR 385-100, the AMC Safety Manual. The evolution of this comprehensive standard began some 55 years ago.

The first manual (left) was a single page, 22" X 30", with 51 regulatory paragraphs. This "acorn" was signed by MG C. C. Williams, Chief of Ordnance, US Army, in November, 1918. Although few in number, these safety rules are as vital now as they were then. The initial document, however, is hardly comparable to the current manual with its one change, 28 sections, and 641 paragraphs, not to mention the numerous sub-paragraphs, tables, drawings, etc.

In 1931 the first "pocket-book" edition was published. This issue was brought up to date in 1941 and again in 1945.


O. O. Form No. 7224

ORDNANCE SAFETY MANUAL

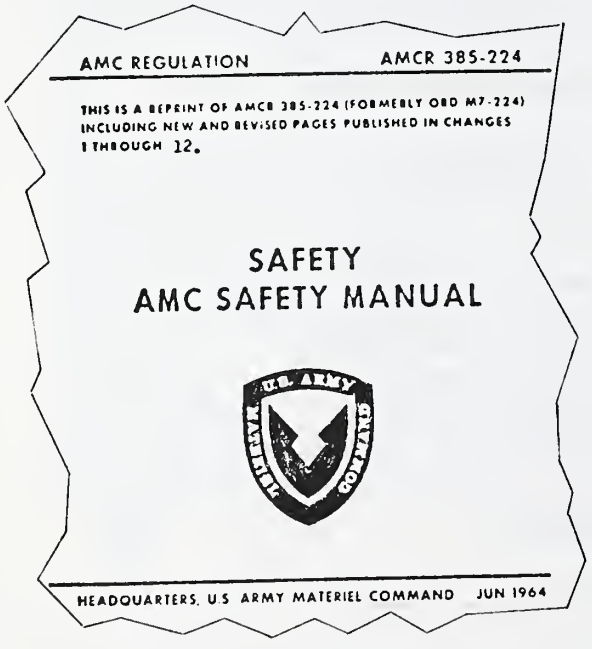
REGULATIONS GOVERNING THE MANUFACTURE, STORAGE, LOADING, AND HANDLING OF MILITARY EXPLOSIVES AND AMMUNITION AT ESTABLISHMENTS OF THE ORDNANCE DEPARTMENT
ARMY SERVICE FORCES
UNITED STATES ARMY

3 May 1945

A new system was inaugurated in 1946. The decision was made to publish Safety Bulletins listing the various precautions to be observed in specific operations and situations. As one might imagine, this method grew rather cumbersome as the volume of bulletins increased.

The ORDM 7-224 published in 1951 represented a consolidation of all the Safety Bulletins. For the first time it was published in a loose-leaf binder. As knowledge and experience increased, it was necessary to revise old requirements and add new ones from time to time. With the loose-leaf construction, making changes in the safety manual was merely a matter of taking out the old pages and inserting the new. Also, it was felt that this would enable installations to remove various sections for use by people who did not need the entire manual.

Shortly after the inception of the US Army Materiel Command in August, 1962, the ORDM 7-224 was redesignated as AMCR 385-224. This latter manual continued in useage through Change 16 in 1969. Within the same time frame, the need for a new standard was realized. A draft safety manual, designated as AMCR 385-100, was sent to the field for comment and in April, 1970, the new loose-leaf, 8" X 10" manual was distributed. This document is currently effective through Change 1, dated 14 October 1971.



Over the years, the basic manual has gradually expanded its coverage to include a variety of areas outside of explosives safety. AMCR 385-100, however, does not provide all the guidance necessary for the operation of a safety program. Other AMC Regulations as well as AMC supplements to Army Regulations cover specific areas of safety not included in AMCR 385-100; i.e., laser safety, aviation safety, radiological safety, etc. Additional guidance in the form of OSHA standards and national consensus standards

such as ANSI and NFPA must be used to supplement the requirements of AMCR 385-100.

Yes....the safety manual has grown by leaps and bounds since 1918, yet, it has never surpassed its usefulness. AMCR 385-100 and its predecessors have made a significant contribution to the advancement of safe operations within the Army, and will continue to do so in the future.

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HOME REPAIR WOES

An inventory of your home might reveal one or more of the following tools:

A Bent Screwdriver (bent when you used it as a crowbar).

A Knife With a Broken Blade (broken when you used it as a screwdriver).

Several Odd Sized Open End Wrenches (odd sized because you either tried to grind the jaws bigger and wound up with something that fits nothing, or else you tried pounding the jaws together and ended up with a wrench that is just fine for tightening up pear-shaped nuts).

A Piece of String 11 Inches Long (for measuring one-foot jobs where you like to add another inch for good measure. Using this method you satisfy your desire to be on the safe side and still come out right the first time).

A Hammer (one or both claws broken off, a mushroomed head, and a split handle. Makes a dandy antique door stop).

A Handful of Bent Rusty Nails and Screws (to be transferred to the fishing tackle box for use as sinkers).

A Brand New Set of Miniature Socket Wrenches (the set bought for 98 cents and used only once. Since then the bolts they fit haven't loosened up).

A Broken Pencil Stub (being kept in reserve for marking a point or a line when the nail normally used wears down. You could sharpen the pencil if you could find where your wife put the wood chisel).

A Variety of Miscellaneous Items (an empty oil can, an unidentifiable "thingamabob" that just might fit somewhere, and a beer can opener in excellent condition).

Armed with such a set of tools, amateur contractors are ready to undertake any repair job whatsoever. Tape a frayed wire instead of replacing it....What can't be nailed down, glue down....What can't be sawed off, break off....What can't be fixed, set aside for another day. Many of the repairs are temporary and usually unsafe. They are temporary until the amateur can get better or proper tools, which never seems to happen.

Replace worn out tools if you want to do a better job in less time and more safely. Do it today because tomorrow is the day the cupboard doors are scheduled to stick.

- Badger Army Ammunition Plant
Olin Corp., Energy Systems Division

LET THE BUYER BEWARE

Larry E. Smith, Safety Specialist
RASA, Missile Command Headquarters Operations
Redstone Arsenal, Alabama

The science of chemistry has produced fluorescent products related to light and visibility. As safety professionals who find an occasional use for these products, safety directors must have an awareness of what fluorescent materials can and cannot do. Fluorescent materials commonly used by accident prevention specialists are sometimes erroneously advertised:

1. "Fluorescent strips, patches or paint increase visibility after dark."

2. "Fluorescent fabric -- Keep out of direct sunlight. Use only at night."

3. "Fluorescent (paint). For painting objects or areas requiring night visibility."

At a time when management is facing continued cutbacks in spending, the safety director must recommend buying only those safety products he has an accurate knowledge of.

The above advertisements were selected from publications well known to most safety personnel. All three are technically incorrect! Fluorescent materials appear unusually bright in the daytime but are not usually bright at night. The fact is, they are less visible than plain white cloth at night under headlamp or street illumination.

The first advertisement above is taken from a safety booklet which advocated marking children's halloween costumes with fluorescent strips, patches or paint to increase their visibility to motorists at night. When the publisher was contacted, an error was admitted and a revised edition of the booklet was issued. The revision called for the use of reflective strips in lieu of fluorescent products.

The second advertisement quoted above was found on labels attached to safety vests intended for use by police officers directing traffic at night. The vests were made of fluorescent fabric. When they were alerted that their fluorescent vests were not effective in the dark, the department had strips of retro-reflective fabric sewed to the vests.

The third advertisement was quoted from a recent sales catalog advertising an acrylic or styrene-acrylic lacquer in a pressurized can. Although some paints do have an afterglow in the dark, fluorescent paint does not. These luminous paints are either self-luminous (energized by radioactive salt) or phosphorescent (pre-excited by an outside energy source and persistently emitting light after the outside energy is removed). Fluorescent materials transform ultraviolet, violet and even blue energy into light, as well as reflect incident light. Their brightness under daylight is striking. This is true because of the ultraviolet energy in daylight, which, after striking the materials, returns to the eye as light in addition to the daylight reflected by the materials. Fluorescent materials, however, do not continue to glow in the dark. If the fluorescent paint was viewed at night under a "black light" (ultraviolet instead of the normal headlamp), it would be extremely visible!

If safety personnel are not aware of what the physical properties of fluorescent materials are, they could mistakenly misuse any of these three products with tragic results!

A conventional red-orange surface reflects just red-orange light and absorbs and wastes all other wavelengths of light. A fluorescent red-orange surface reflects not only that portion of the spectrum we perceive as red-orange, but it converts the shorter wavelengths of ultraviolet and other colors into longer visible energy in this red-orange wavelength. It is much the same as the energy of electric current transformed into light in an incandescent lamp.

Normal objects around us do not change the wavelengths of the light they receive. The energy of a given wavelength which they receive is reflected back by them in the same wavelength. They do not reflect everything, however, since a portion is absorbed.

Fluorescent materials convert light to the visible wavelength when they are in the path of a short wavelength light source. Thus, reflected color is reinforced with converted color, producing color effects that have approximately four times the light energy as the nonfluorescent surface.

The safety officer purchasing fluorescent safety products should consider the following:

1. Fluorescent materials must be stimulated by light to increase their visibility. Ultraviolet light is an extremely stimulating source.

2. Fluorescent materials do not emit light after the light source is removed.

3. Under daylight conditions, fluorescent materials result in color that is visible and discernible at greater distances than conventional color.

Many fluorescent products are sold with appropriate descriptions and accurate advertising. These fluorescent products are often referred to as follows:

"Fluorescent portion....catches the eye quickly under all daylight conditions."

"Fluorescent color....for daytime emergencies."

"Daylight fluorescent color."

"Day Glo fluorescent colors."

A good example of a product requiring both day and night visibility is the slow moving vehicle emblem. This emblem includes an orange fluorescent center for daytime recognition. At night the red reflectorized borders of the emblem assure instant recognition.

Safety managers must become familiar with today's technical safety materials, methods and terminology. The buyer of safety products must beware of misleading information.

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BEWARE OF DEBRIS ON COMMERCIAL RAMPS

Many flights conducted by AMC pilots require that the aircraft be landed at large civilian airfields to drop off passengers connecting with commercial airline flights. Because of the precautions taken to prevent hijacking, these passenger drops would most likely be at the Fixed Base Operations. Many of these Fixed Base Operations at major airfields have extensive cargo operations in progress. As a result of these cargo operations, debris such as loose wood, nails, nuts and bolts and steel bands is left lying around on the ramp. In addition to the debris problem, the large reciprocating engine aircraft used to fly the cargo drip an excessive amount of oil in the ramps and parking areas. The combination of the debris and oil could become a serious hazard to taxiing aircraft unless extreme care is exercised by incoming aircrafts. Remember strange airfields sometimes have strange conditions. Taxi slowly and be alert for loose material that might be ingested into aircraft engines which would result in Foreign Object Damage (FOD).

LOUISIANA ARMY AMMUNITION PLANT PRESENTED CECIL L. HIGHTOWER MEMORIAL SAFETY AWARD

LTC M. G. Swindler, Commander, Louisiana Army Ammunition Plant (LAAP); and Mr. E. A. Vihstadt, General Manager, Sperry Rand, operating contractor at LAAP are shown with the Cecil L. Hightower Memorial Safety Award. The award was presented to LAAP in recognition of its significant contributions to the cause of safety in the Ark-La-Tex area. At the time of the award presentation, LAAP had accumulated more than 6,787,000 injury-free man-hours, and the record was continuing. This commendable achievement and a low motor vehicle accident frequency rate were the basis for LAAP's being presented the award.

The award, initiated in 1960, is in honor of Cecil L. Hightower, who was Safety Director of United Gas Company from the mid-1930's to the late 1950's. Mr. Hightower was instrumental in forming the Ark-La-Tex Chapter of ASSE, the author of many well-known books on industrial safety, and was nationally prominent in the safety field.

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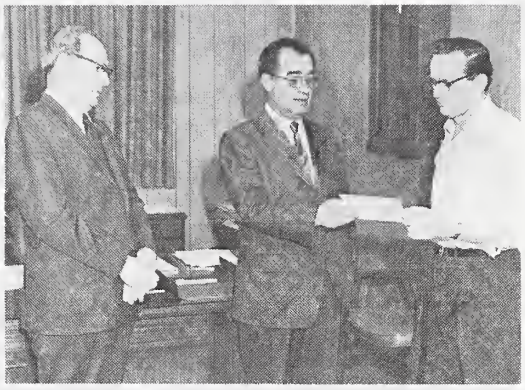
SAFETY EQUIPMENT PROTECTS THREE FROM INJURY

Raymond Coake, Gilmer Hurst, Sr., and Herman Hearn are three men who are happy that personal safety equipment is furnished and required to be worn at Radford Army Ammunition Plant.

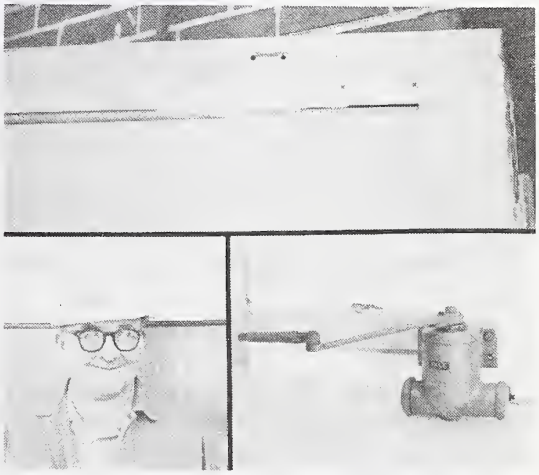
Coake, a maintenance mechanic in the Acid Area, was replacing a flanged joint on an acid line when nitric acid sprayed from the opening

onto his face, causing first and second degree acid burns. Coake was wearing acid goggles during his work which saved his eyes from possible damage. He is shown, at right, receiving his membership in the Wise Owl Club from H. R. Davies, Manager. C. R. Edwards, Safety Superintendent, looks on.



Gilmer Hurst, Jr., a mechanic in the Acid Area is shown at left (center) receiving the Gold Shoe Award from H. R. Davies, Manager. Hurst was on a tank car unloading platform when his right foot became caught between a toe board and a descending cantilevered walkway. Had he not been wearing safety shoes, it is possible that several of his toes would have been amputated. As it was, the shoe was ripped open over the steel safety toe.

Last month while emerging from his Acid Maintenance Shop, Herman Hearn started to open the door. The wind was extremely brisk and it flew open. At the same moment, as Mr. Hearn was on the threshold of the opening, the force of the wind on the door separated the steel closer from the top of the wooden door and swung the 25-pound steel closer onto his head. Fortunately, Mr. Hearn was wearing his hard hat. Had he not, the story we are telling would have been quite different. Mr. Hearn has been nominated as a member of the Turtle Club.



The photos (above right) show the closer that struck Mr. Hearn, the fresh wood from which it was torn and a smiling picture of Mr. Hearn who was glad he was wearing his protective headgear.

Here are ten questions that will test your knowledge of safety requirements that you will need under different circumstances. Answers to these questions may be found in the AMCR 385-series and AR 385-series. How many can you answer without referring to the regulations?

1. What groups of employees should be given first-aid training at an installation?

   Answer and reference:

2. What common fire hazards should be watched for during fire inspections?

   Answer and reference:

3. What factors must be considered when determining limits for hazardous materials?

   Answer and reference:

4. What are the safety requirements to be observed when repairs to a magazine are necessary?

   Answer and reference:

5. What types of vehicles are preferred for use in transportation of ammunition, explosives and other hazardous materials?

   Answer and reference:

6. What are the inspection requirements for motor vehicles used for transportation of hazardous materials?

   Answer and reference:

7. What type of hand tools may be used by electricians?

   Answer and reference:

8. What is a chemical incident?

   Answer and reference:

9. For statistical purposes, when should a person who is missing be recorded as a fatality?

   Answer and reference:

10. Can an installation ever have a "negative" Summary Report of Federal Occupational Injuries and Illnesses for Civilian Personnel, DA Form 3885-R?

    Answer and reference:

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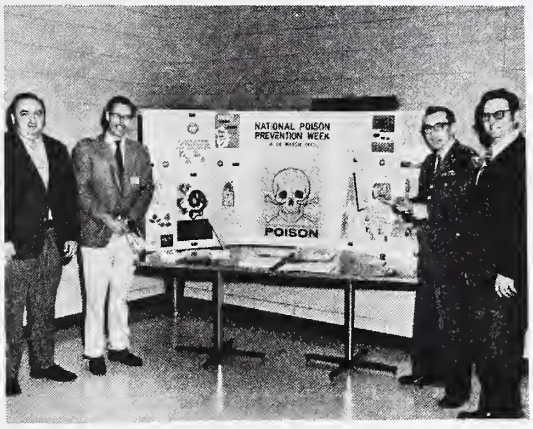

NATIONAL POISON PREVENTION WEEK OBSERVED AT ARMY MATERIALS & MECHANICS RESEARCH CENTER

National Poison Prevention Week was observed with an all-out poison prevention campaign at the Army Materials and Mechanics Research Center (AMMRC). In addition to a film, leaflets and exhibit, Dr. Frederick Lovejoy, Executive Secretary of the Boston Poison Information Center, presented a talk to an assembly of all AMMRC employees.

In the photo above (left to right) Mr. Sidney Levin, Chief, AMMRC Radiation and Occupational Safety Branch; Dr. Lovejoy; LTC Robert B. Henry, Commander; and Mr. James F. Hall, Safety Inspector, discuss the AMMRC poison prevention exhibit.

KEEP A FEW ACES UP YOUR SLEEVE

By Robert E. Babis

ACCIDENT brief: N1234B, Cessna 310 - Pilot had unsafe nose-gear indication. Nosegear still unsafe after complying with cockpit emergency procedures. Requested a low pass by tower for visual inspection. Was informed that nosegear was swinging freely. Pilot elected to land on Runway 31, Craig Field, and requested that emergency equipment be standing by. Aircraft landed and nosegear collapsed on slow rollout. Minor damages, no injury.

Analyst's comments: We give this lad an above average for headwork. When he recognized the problem, he took time to think about it, and had the good sense to seek assistance outside the cockpit.

When flying, incidents will often occur over which you have no control. The above item is a good example. What could possibly have been a serious accident with injuries was avoided because of the pilot's positive action and his putting every possible factor in his favor. Success stories like these just don't happen. They are the result of good planning and a basic flying philosophy which incorporate the use of everything available.

Let's take the above incident again and back up a couple of hours. Say the pilot had taken off from New Orleans and arrived at Jacksonville with about 35 to 40 minutes of fuel remaining. Mix in darkness and marginal visibility. Oh, yes, he had also "boomed it" in New Orleans the night before. The same incident, but the probable outcome is less certain. Why?

Poor weather and short fuel supply tend to make actions more urgent. The pilot's options are reduced. Time to consult with other airborne aircraft, or to divert, is diminished. In effect, once your options are gone, you have lost control of that flight, and successful completion becomes less certain. This realm of uncertainty is the beginning of unsafe flight.

As we gain experience (the longer we survive), we find there are fewer "either/or" situations. Most things offer a choice somewhere between extremes from which we can select. Aviation can be placed on such a spectrum between the extremes of safe and unsafe. Not only does the distance between those two extremes vary, but the point of an unsafe condition varies. Just where a flight becomes unsafe along this spectrum depends on the factors involved. With me, it varies from day to day. In fact, it varies for each flight, and it may change during the flight. For each mission, there are a set of circumstances that describe safe flight. The

exact point where the mission or flight becomes unsafe is largely dependent on things that the pilot controls. For example:

Pilot - good physical condition, well-rested, an absence of hunger, hangover, and hangups.

Aircraft - Servicing personally checked, minor discrepancies noted, major discrepancies corrected.

Environment - Weather checked, lighting and obstructions noted, and an "out route" planned.

Management - Alternate courses of actions planned. Always have at least two places to go.

A friend of mine, a Pan-American pilot and a fellow Naval Air Reservist, summed it up when he said, "Aviation safety is not playing your aces early." He's right. Search out the options in planning and expand your alternatives. The beautiful thing about the flying business is that most of the time you're able to stack the deck in your favor.

None of us can afford to ignore facts and conditions which diminish the certainty of successfully completing a flight. Summing up, the margin of safety is yours to control. The aviation spectrum of safety is a variable, with size a function of controllable factors. Be positive, be aggressive, have a few options, and ...keep a few aces up your sleeve.

Approach/April 1973

Well, Did You Know?

Here are the answers to the questions on pages 22 and 23. A reference to the pertinent regulation and paragraph follows each answer.

1. Electricians, maintenance men, guards, firemen, foremen, attendants and orderlies in the first-aid room, and other job categories selected by the installation safety director as having job-related need for the training shall be given first-aid training.

   Reference: Paragraph 1-19, AMCR 385-100.

2. Each part of an installation should be inspected on a scheduled basis for common fire causes such as poor housekeeping, smoking violations, excessive accumulation of flammable materials, improper containers for dispensing flammable materials, improper storage of flammable materials, process fire hazards, blocked fire doors and exits, seasonal fire hazards, and other fire hazards.

   Reference: Paragraph 12-6a, AMCR 385-100.

3. Determination of limits for hazardous materials requires careful analysis of all facts including operation timing, transportation methods, size of the items, and the chemical and physical characteristics of the material.

   Reference: Paragraph 16-1b, AMCR 385-100.

4. When magazines are repaired, the general requirements set forth in AMCR 385-100 are mandatory -- particularly those relating to the elimination of fire hazards. The following special requirements are also mandatory:

   a. All work must be done by competent workmen, under competent supervision.

b. Safety tools must be used as required by paragraph 16-11, AMCR 385-100.

c. The floor in the immediate vicinity of the repair must be scrupulously cleaned.

d. No work requiring soldering, melting of asphalt, or use of flame or heat producing equipment shall be done in a magazine containing explosives or ammunition.

e. Magazines in which repair work has been done shall be inspected by competent authorized personnel after completion of the work.

f. When melting pots or any other heat producing apparatus are authorized by the Commander for use in any ammunition and explosives storage area, the equipment must be kept at least 90 feet from the ammunition or explosives location. When necessary, baffles and screens should be used to confine sparks and flames to heating apparatus.

Reference: Paragraphs 18-12b(1) through (6), AMCR 385-100.

5. Cargo type trucks and truck-tractor drawn semi-trailer vans are the preferred types of equipment for transporting ammunition, explosives and other hazardous material.

Reference: Paragraph 22-5, AMCR 385-100.

6. Government-owned motor vehicles used for transportation of hazardous materials shall be inspected at frequent intervals by a competent person to see that mechanical conditions and safety appliances are in good working order and that oil and motor pans under engines are clean. Daily inspections shall be made to determine that:

a. Fire extinguishers are serviceable.

b. Electric wiring is in good condition and properly attached.

c. Fuel tank and piping are secure and not leaking.

d. Brakes, steering and other equipment are in good condition.

e. The exhaust system is not exposed to accumulations of grease, oil, gasoline or other fuels, and has ample clearance from fuel lines and other combustible materials.

Reference: Paragraph 22-6, AMCR 385-100.

7. Electricians shall use nonmetallic tools wherever possible. Fiber fuse pullers, foot rulers without metal rims, cloth tapes without wire reinforcements, and insulated handles on those metal tools that are necessary are essential to safety.

   Reference: Paragraph 9-17h, AMCR 385-100.

8. A chemical incident is any situation involving a chemical agent that results in:

   a. Exposure of personnel to a chemical agent.

   b. Release of chemical agent without exposure of personnel which is not reported as a minor leak or as a chemical accident.

   c. Attempted theft.

   Reference: Paragraphs 2-15b(1), (2) and (3), AR 385-40.

9. For statistical purposes, a person who is missing and after investigation presumed to have met with an accident, should not be recorded as a fatality until the body has been recovered or until he has been officially declared dead.

   Reference: Paragraph 3-5, AR 385-40.

10. No. In order for the DA Form 3885-R to be completed, it must indicate the total man-hours worked by employees (Item 40), and the average number of employees (Item 50).

    Reference: Figure 10-1, AR 385-40.

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NEW PUBLICATIONS

AR 55-55, Ch 5 7 Mar 73	Transportation and Travel - Transportation of Dangerous or Hazardous Chemical Materials
AR 55-56, Ch 3 5 Apr 73	Transportation and Travel - Transportation of Radioactive and Fissile Materials Other Than Weapons
AR 385-40, Ch 1 21 Feb 73	Safety - Accident Reporting and Records
AR 385-41, Ch 5 27 Mar 73	Safety - US Army Accident Codebook
DA Cir 385-38 12 Mar 73	Safety - Training for Army Safety Personnel
DA Cir 385-39 28 Mar 73	Safety - Safe Operation of Truck, Utility, ¼-Ton, 4X4, M151 Series
DA Pam 385-1 15 Mar 73	Safety - Unit Safety Management
AMC Suppl 1 to AR 385-10, Ch 1 20 Mar 73	Safety - Army Safety Program
AMC Suppl 1 to AR 385-40 14 Feb 73	Safety - Accident Reporting and Records
AR 385-65 13 Apr 73	Safety - Identification of Inert Ammunition and Ammunition Components

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U.S. GOVERNMENT PRINTING OFFICE: 1973—513-511:8